COMPONENT BREAKOUT:

AN ANALYSIS OF DECISIONS

THESIS

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Kelly V. Sherwin

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Abstract

This purpose of this study was to examine and analyze the component breakout decision process. The research methodology consisted of a literature review, and personal interviews with Aeronautical Systems Division program office directors and their staffs. Then an examination of records concerning prior breakout decisions was conducted to compare available data.

The research revealed that the use of component breakout varies among the System Program Offices, and each office approaches the breakout decision process differently. Currently there is no standard method for estimating the savings, however, one available computer model could become a basis for standardizing breakout decisions. Often a non-breakout decision is made without identifying all relevant variables concerning the process. There is little guidance for the program offices for converting from contractor furnished equipment to Government furnished equipment. The documentation concerning the breakout process is sometimes fragmentary.

Among the recommendations of this study was the need for a consistent method to calculate component breakout savings, and fully document the breakout decision. That would help organizations make sound breakout decisions and then the considerable savings produced by component breakout could be realized.

COMPONENT BREAKOUT: AN ANALYSIS OF DECISIONS

I. INTRODUCTION

Overview

The Air Force spends billions of dollars every year acquiring weapons systems. Often in complex, high cost systems, some subsystem components are procured by the prime contractor through another commercial vendor for end use in the acquired system. This practice results in additional costs, since the prime contractor is assuming risks, incurring expenses and will be paid a fee for performing the middleman functions. The Air Force might assume the responsibility of procuring some high cost components directly from commercial vendors and provide the components to the contractor, a procedure called component breakout. The use of component breakout may reduce the overall weapon system cost.

Specific Problem

Although current Air Force regulations require System Program Offices to review all procured equipment for component breakout opportunity, many inspection reports conclude that breakout activity within the Air Force is not effectively used. Why the breakout program is or is not

used, and how cost effective the breakout programs are, will orient the nature of this research.

Research Objectives

This research will be focused on analyzing associated factors in System Program Offices concerning the decision making process on component breakout programs. Then, using a computer model developed by Dr. Patrick J. Sweeney for the Air Force Business Research Management Center (14), the researcher will examine the hypothetical savings or losses of the component breakout decision and compare the results to the actual program data. Finally, this study will attempt to identify problem areas and suggest recommendations to help program managers make sound breakout decisions.

Research Questions

In order to complete this research, data will be gathered to answer the following investigative questions:

1. What factors influence the "yes"/"no" decision concerning component breakout?
2. What are the predicted savings or losses that result from using component breakout?

Scope and Limitations

This research will be limited to studying major unclassified weapons systems. The research will be based on data collected from the Aeronautical Systems Division (ASD). Approximately 60 percent of the Air Force System Command's (AFSC) breakout activity results from ASD projects (10:8).

The anticipated data and resources required for the research are expected to be readily available at ASD. The study also assumes the Sweeney computer model is accurate in its prediction of savings and losses.

II. REVIEW OF LITERATURE

Introduction

In 1776, Adam Smith discussed the importance of the "invisible hand" working within the marketplace of competing buyers and sellers, each of whom pursues his own interests, in driving the economies of society (16:41). Economic texts today continue to emphasize the theory of competition in various forms. Advantages of competition commonly cited are the development of enterprise, stable employment, removal of inefficient firms and freedom from monopoly and cartel control (16:41). One example of competition that DOD exercises in the marketplace is component breakout. This chapter will examine the role of component breakout in past and present acquisition policies, and then concentrate on current problems in managing the breakout process.

Topic Statement. This research will analyze the role of component breakout in ASD acquisition policy. The main topics covered are past and present uses of component breakout and critical areas influencing the successful use of component breakout.

Definitions. Component breakout is the process of acquiring weapon system components directly from the manufacturer and providing them to a prime contractor as Government Furnished Equipment (GFE) (3:9). Government Furnished Equipment is an item in the possession of, or

acquired by, the Government and delivered to or otherwise made available to the contractor (3:32).

Justification. Breakout is a Government attempt to save money by eliminating costs associated with the middleman role performed by the prime contractor. Breakout seems to be a relatively straight-forward method of reducing weapon system costs. In practice, however, the breakout decision is quite complex. Weighing the benefits and risks of implementing breakout is highly subjective and few clear guidelines exist (15:1).

Organization. In examining component breakout, a historical perspective will be presented first. Then the emphasis will shift to the substantial changes in weapon systems acquisition environment and factors influencing the breakout process.

Analysis of the Literature

Component Breakout in the Fifties. During the late 1950's, DOD procurement agencies had noticed the increased weapon systems costs caused in part by prime contractor "middleman" integration responsibility. Air Force procurement agencies frequently lacked the necessary personnel required to perform system integration responsibilities. Consequently, the Air Force (and other DOD departments as well) delegated the task of integration to the prime contractor. In this role the prime contractor

subcontracted components and received a profit on the component part.

Generally, as a program matures and reaches stable production, the system integration function descends on an importance ladder (12:103). With this in mind, the Army began breaking out items for direct procurement and providing them to prime contractors as GFE (12:103-104). The Army's successful breakout program, where the Nike-Hercules program alone reported savings of over $11.3 million, led to Congressional insistence that the Air Force and Navy each have their own component breakout programs (12:108). Congress not only viewed component breakout as a means of achieving cost savings by eliminating the prime contractor's middleman role, but also as a means of possibly increasing the level of competition in weapons acquisition (12:105).

Component Breakout in the Sixties. When Secretary of Defense (SecDef) Robert F. NcNamara took office, he directed that component breakout planning be incorporated into the military services' procurement planning programs. As part of the directive, the military services were required to initiate plans to acquire technical data packages so that maximum competition could be sought during the breakout process (19:17). Although DOD did not issue a formal regulation until 1 December 1965, substantial breakout activity occurred during the 1960's. For instance, the Navy

alone converted 43 components to GFE in the P-3, H-46, F-4, and A-6 aircraft programs at a reported cost savings of 19.2 million dollars (2:35). Even though these reported cost savings did not include the "hidden costs" of managing GFE, the prospects for achieving substantial savings through component breakout for the weapons systems being developed during the late 1960's looked extremely bright.

Breakout During the Seventies. In the 1970's, mounting evidence supported the belief that the Services were not breaking out components to the maximum extent possible. As an example, the Navy's F-14 fighter program reported the breakout of only five components (2:36). The same was true of the Air Force's F-15 fighter program and the Army's Blackhawk Helicopter program, both reported a minimum of breakout activity. In one report involving the Air Force F-15 program, the conclusion stated that management did not address all items eligible for breakout (18:28). The conscious decision not to breakout 12 components on the F-15 resulted in additional costs of $4.2 million and breakout of other items could have avoided additional costs of $15 million (18:266).

One Air Force Audit Agency report cited the avoidance of component breakout for aircraft (18:280). Furthermore, a savings of $6.7 million could have been achieved through the breakout of equipment common to other Air Force programs. Based on the findings of the Audit Agency report, the House Appropriations Committee asked the SecDef to "give his

attention to the operation of this program in the military departments"(18:266).

To determine the extent of service compliance with DOD's component breakout policy, the House Appropriations Committee, on August 15, 1979, tasked its staff to study DOD component breakout policy and procedures. The study took place between August 1979 and April 1980. The results of the study stated that, in general, DOD activities were not, for various reasons, following the Defense Acquisition Regulation regarding component breakout. The staff study further found a spectrum of interpretations of component breakout policy as well as varied service practices (2:38).

Breakout in the Eighties. The Reagan administration's commitment to improving national defense and increasing military spending placed high level interest on weapon system acquisition procedures. National attention centered on overpriced spare parts. In May 1983 the Air Force Management Analysis Group (AFMAG) was formed to study the issue (6:5). In October 1983 the AFMAG released 159 recommendations for correcting the problems involved with Air Force acquisition procedures. Several examples cited specifically that overpriced parts resulted from poor breakout management (6:40-168).

A central theme throughout the AFMAG report was that spare parts breakout should continue throughout the life of the system. The report noted, however, that lack of

manpower and the inability to motivate acquisition personnel are impediments to a successful breakout program (6:168). The AFMAG report recommended the establishment of a functional award recognizing excellence for increasing breakout activity and spare parts competition (6:168). The report also recommended that a management rating system for the Air Logistics Center organizations be restructured to have a more balanced evaluation of an organization's effectiveness in relation to pricing, negotiation, competition, and breakout activity (6:16-18).

Current Status. Today's leaders have varying concerns over effective use of component breakout. Advocates are attempting to increase the amount of component breakout as a cost saving measure. While some observers are critical of component breakout control procedures and management, both sides agree the impetus of cutting costs in acquiring weapons systems is worthwhile. However, they disagree on whether or not the component breakout program is effectively tracked or managed in DOD.

One advocate of component breakout, General Lawrence A. Skantze, stated in a recent speech:

> ...in 1985 we saved $16 million by breaking out 786 items of non-complex support equipment for F-15, F-16 and four other systems. Buying from small business instead of prime contractors saved 30-40 percent of the total cost [13:8].

General Skantze defended component breakout as "sustaining a healthy arms-length relationship between the Defense Department and industry"(13:9). However, Congressman Jack

Brooks believes government furnished equipment is not effectively managed and tracked.

Congressman Brooks concluded hearings in Washington by stating his opinion on control of material and equipment DOD provides to contractors:

> Substantial amounts of government furnished material and equipment remain unaccounted for and there is little doubt that millions of dollars worth of this property is being lost every year. The Defense Department assured us that they have been working to implement a system of accountability, but the situation is about the same as in 1981. We intend to continue monitoring DOD's actions to ensure that these deficiencies are finally corrected [17:120].

During testimony, the Congressional Committee had been told of billions of dollars of government furnished equipment under prime contractor control, much of it unaccounted for by DOD (17:103-115).

While various authorities differ in their concerns over component breakout effectiveness, one underlying principle appears to apply. If the expected benefits are large and the risks to the government are acceptable, the component should be broken out (15:2). The Federal Acquisition Regulation (FAR) states that if risks are not acceptable, then DOD should acquire the component through the prime contractor and investigate ways of eliminating conditions unfavorable to the breakout decision (15:3).

Current Factors Influencing Breakout Decisions. One recent study looked at the FAR guidelines for component breakout and examined four critical areas affecting the

component breakout decision (15:1). The four areas were: 1) design stability, 2) manpower requirements, 3) data availability, and 4) savings estimation (15:3). In the concluding remarks of the study, a salient point is made. "Overall, the difficulty in making sound breakout decisions lies in balancing relatively tangible cost savings in the present against intangible program risks in the future" (15:12). This uncertainty may account for some of the program managers' unwillingness to accept the unknown risks of a component breakout policy.

Congressional pressure in the late 1950's forced the Air Force to develop a component breakout program. Since then, Congressional emphasis has advanced policies favoring breakout activity. The current DOD policy regarding component breakout is:

> 1. Whenever it is anticipated that the prime contract for a weapons system or other major end item will be awarded without adequate price competition, and the prime contractor is expected to acquire a component without such competition, it is Department of Defense policy to break out that component if:
>   (a) substantial net cost savings will probably be achieved; and
>   (b) such action will not jeopardize the quality, reliability, performance or timely delivery of the end item.
>
> 2. The desirability of breakout should also be considered (regardless of whether the prime contractor or the component being acquired by the prime contractor is on the basis of price competition) whenever substantial net cost savings will result (1) from greater quantity acquisitions or (2) from such factors as improved logistics support through reduction in varieties of spare parts and economies in operations and training through standardization of design. Primary

> breakout consideration shall be given to those components of the end item representing the highest annual acquisition costs and offering the largest potential net savings through breakout [7:17202-2].

The System Program Office (SPO) is responsible for component breakout review and selection. Within each SPO, a team of experts is designated to review all procured equipment for breakout potential. This team is headed by a program director and staffed with a small business specialist, engineering, production, logistics, maintenance, contracting, and other individuals necessary for evaluating the component under consideration (7:17202-3). The DOD Inspector General (IG) provides further guidance on breakout activity:

> Normally, components of a system should be reviewed annually for breakout when the expected cost is $1 million or more. The FAR identifies circumstances that could preclude breakout of components, but indicates that the acquiring activity should eliminate these circumstances if feasible. The regulation also requires the activity to maintain documentation showing evidence that breakout reviews were performed. The documentation should include a list of components reviewed and show those components that have no potential for breakout, those that are susceptible to breakout, and those for which a decision on breakout has been made [8:2].

In spite of Congressional recommendations and regulatory requirements covering component breakout activity, many inspection agency reports cite deficiencies in the Air Force's breakout programs. An Air Force Audit Agency (AFAA) Summary Report of Audit (SRA) stated:

> Overall, the component breakout program within the Air Force could be more effective. There was a wide range in the extent of program

implementation among the system program offices. Three program offices reviewed had effective, aggressive component breakout programs and estimated, at the time the breakout decisions were made, savings of $113 million to $138 million. However, six other program offices reviewed did not aggressively pursue a component breakout program. Based on a selective review of contractor furnished equipment, we identified possible candidates for breakout within the F-15, F-16, A-10, B-52, and TRI-TAC Troposcatter program offices which were brought to management's attention in local reports. The following conditions in the Air Force component breakout program existed.

a. Concern over the disadvantages of component breakout has led to fewer breakout decisions than possible. Program offices generally stress (1) increased workload without an increase in assigned manpower, (2) contractor furnished equipment/government furnished equipment integration problems, and (3) configuration management difficulties, rather than following FAR requirements to consider the feasibility of eliminating conditions unfavorable to breakout.

b. Lack of standard Air Force guidelines for preparing cost analyses to support decisions for or against breakout have resulted in one program office overestimating offset costs, a second program office not considering potentially significant offset costs, and a third program office not performing timely cost analyses. Further, we were unable to determine the cost analysis methodology used by four remaining program offices because documentation was not maintained [5:2-3].

An AFAA SRA examining Acquisition Management and Installation Management in the KC-135/CFM56 Reengine Program reported:

The KC-135 system manager had not initiated an effective component breakout program for the KC-135/CFM56 reengine modification. The system manager had not established a breakout review committee to evaluate the potential breakout of contractor furnished equipment for the fiscal year 1984 production contract. Except for HQ AFLC directed breakout of the CFM56 engine, breakout of the reegining kit components was

not pursued. Management of OC-ALC believed the personnel required to manage the additional acquisition efforts resulting from breakout would not be available. With the breakout program, over $40 million in gross savings could be realized for the procurements planned during fiscal years 1984-1989 [4:4].

The DOD IG in its review of component breakout programs for the F-15 aircraft stated:

> The component breakout program for the F-15E aircraft can be improved. The F-15 System Program Office identified 22 parts to be broken out in FY 1986 with an estimated cost savings of $3.9 million over the remaining procurement life. However, 52 additional subcontracted parts were candidates for breakout. At the time of the audit, the Air Force supply system purchased 48 of the 52 parts as replenishment spares. These parts remained contractor-furnished equipment because the SPO did not: develop and maintain an accurate list of candidates for breakout; update and document technical assessments from in-house engineers; obtain price quotes from subvendors before deferral decisions initiate actions to overcome excessive administrative and production lead times; or adequately document decisions. The F-15 SPO could avoid prime contractor surcharges of $63.4 million over the remaining F-15E procurement life if the 52 parts were broken out. In addition, 20 of the 48 parts purchased by the supply system had assets in excess of calculated requirements that could have been used to satisfy F-15E production needs at an additional savings of $11.9 million [8:5].

The previous examples indicate that millions of acquisition dollars are lost through poorly managed or virtually non-existent breakout programs. As the defense budget becomes susceptible to national budget deficit reduction action, everything possible must be done to assure the defense portion of the budget is wisely and efficiently spent. Improved component and spare part breakout programs could help reduce weapons system costs.

Conclusion

During the last thirty years, component breakout use has generally been an accepted practice among policy makers and program managers. However, component breakout use has not been as extensive as many would like, nor as effectively managed and tracked as others would like. As weapon systems grow in complexity and sophistication, an increasing number of parts become eligible for breakout consideration. But program managers are also wary of the unknown risks associated with breakout decisions, and often will demonstrate reluctance in accepting these risks. Many managers and policy makers know that success has many parents, but failure is an orphan.

In the 1950s, component breakout attracted attention with the success of the Nike-Hercules program. When component breakout gained Congressional interest, Congress asked the Air Force and Navy to begin their own component breakout programs. The 1960's formalized component breakout policy with regulations and management instructions. The end of the Sixties painted a bright future for component breakout. The 1970s, however, were a decade of little support, and subsequently fewer parts were broken out. The Eighties have brought both advocates and skeptics of component breakout to the forefront on policy and budgets. And currently there are critical areas which are analyzed

before a commitment for or against component breakout is rendered.

More than two hundred years ago, Adam Smith spoke of the "invisible hand" manipulating the economies of society through buyer and seller motivation. Nearly one hundred years before Adam Smith, Francis Bacon wrote a prophetic maxim:

> ...by far the greatest obstacle to the progress of science and to the undertaking of new tasks and provinces therein, is found in this--that men despair and think things impossible [1:511].

III. METHODOLOGY

Introduction

This chapter presents the approach to answering the research questions posed in Chapter 1. Included in this chapter are the justification, instruments to be used, population of concern, the type of data, location of the data sources, description of the data gathering process and methods of analysis to be performed. Only unclassified weapons systems will be addressed in this research. Key assumptions and a brief summary conclude this chapter.

Justification

ASD does not currently have a standard method for determining when the use of component breakout is warranted, other than the best judgment of the SPO director. Should one find a more structured procedure, or a standardized, effective method to determine appropriate breakout use, it may reduce acquisition costs and simplify the decision making process for SPO directors.

Instruments

In answering the research questions, a combination of primary and secondary data will be studied. Primary data come from the original sources and are collected especially for the task at hand. Studies made by others for another purpose represent secondary data (9:135). The use of the interview, in gathering the primary data, will build the foundation for determining factors influencing breakout

decisions, to answer the first investigative question. Secondary data will be used in computing cost projections and comparisons, in answering the second investigative question.

Three broad conditions must be met to have a successful personal interview. They are: (1) availability of the needed information from the respondent; (2) an understanding by the respondent of his or her role; and (3) adequate motivation by the respondent to cooperate (9:161). The design and question structure of the interview are intended to facilitate these conditions.

Population of Concern

This study directed its efforts within sixteen two-letter organizations at ASD. The SPO directors were the population of concern for the interviews, since they make the final component breakout decisions.

Prior to conducting the SPO directors interviews, the researcher conducted unstructured interviews with select faculty members at the Air Force Institute of Technology for procedures covering component breakout decisions. The purpose of the faculty interview was to establish a reasonably unbiased interview format covering breakout policies and refine the question construction with respect to four critical areas. They were (1) question content, (2) question wording, (3) response form, and (4) question sequence (9:228). From the faculty interviews the researcher established a final interview format for SPO

directors. During the interviews of the SPO directors, the researcher gathered data concerning the factors associated with decisions for using component breakout practices.

Type of Data

The basic information gathered from the interviews of SPO directors was nominal and ordinal level data.

Additional data was collected covering a random sample of breakout decisions. This data was entered in the computer model developed by Dr. Patrick J. Sweeney, of the University of Dayton. The computer output will be compared to the actual data recorded by the SPO. The differences between the computer predictions and actual data will be analyzed for significance.

Location of the data. This study limited the data collection to ASD SPOs. Earlier in this study it was noted that approximately 60 percent of AFSC's breakout activity resulted from ASD projects (10:8). The anticipated resources and data are expected to be readily available at ASD.

Description of the data gathering process. Both unstructured and structured interviews were used in the data collection process. The unstructured interview was used in AFIT faculty interviews. During the unstructured interview, the interviewer did little more than keep the interviewee's comments focused on the topic of interest. The greatest value of this technique lies in the depth and detail of

information that can be secured (9:160). "Interviewers can note conditions of the interview, probe with additional questions, and gather supplemental information through observation" (9:160). Response error bias was minimized through the assurance of respondent anonymity when required.

Several disadvantages were considered in the conduct of interviews. An interviewer who does not take shorthand notes causes the data to be an inexact transcript of the response, however content description should remain as close as possible to original meaning. A second area of difficulty was the ability of the respondent to provide unbiased, and objective answers. This was compounded by memory bias or a lack of information about the topic (11:76). The researcher minimized these potential detractors through structured questions to elicit specific, objective responses when possible.

Additional data were obtained from the SPOs. A random selection of breakout decisions was examined and analyzed using microcomputer technology. A data set was constructed and entered into the recently developed component breakout computer model, which provided a basis for comparing actual breakout data to projected results. The researcher then compared the actual component breakout decisions to the computer model's output. By analyzing the computer results and comparing it to the actual results, projected savings and losses versus the actual savings and losses were obtained.

By comparing the current methods of determining whether or not a component should be broken out, and the computer solution in making that determination, the researcher expected to make recommendations concerning component breakout procedures.

Assumptions

1. Any factor influencing a breakout decision and omitted from the interview will be assumed to have had no impact on the research results.

2. This study assumed each interviewee interpreted each question in the same manner.

In a 1987 study (10:39), the following became the list of rank ordered factors used to justify non-breakout decisions:

1. Excessive program risk
2. Lack of technical stability
3. Lack of lead-time/schedule constraints
4. Insufficient cost savings
5. Lack of data/specifications required for reprocurement
6. Component complexity too high
7. Lack of manpower for increased management responsibility
8. Safety restrictions
9. Lack of timely procurement fund availability
10. Component warranty restrictions
11. Quality/manufacturing problems
12. Insufficient regulatory guidance

This ASD expert's ranking is assumed to still be valid.

Dr. Patrick J. Sweeney's computer model assumptions include:

1. Design is stable.
2. Data package is available.
3. Quality and reliability of component can be resolved without end item contractor support.

4. Technical support is minimal or can be furnished by the government.
5. Logistics problems are minimal.
6. Administration, management, and performance of the end item contractor not affected.
7. Delivery of the end item not jeopardized.
8. Advance procurement funds are available, if required.
9. Another source is available to provide component.
10. The component has been or may be a GFE item.
11. The government will assume the role of the prime contractor for this component.

The computer model uses several natural areas that closely parallel the normal activity associated with the component breakout process. The component breakout process may include the following activities and are used when appropriate: screening, price analysis, source approval, source development, source selection, reverse engineering, first article acceptance, contracting costs (pre-award survey, general SPO costs), administration and audit costs, security costs, EEO support costs, socio-economic costs, warranty costs, termination costs, new equipment costs, facility modification costs, transportation costs, and solicitation costs. The sum of these costs (when and where one considers them applicable) becomes the total SPO cost. Each of these activities will be addressed in subsequent paragraphs.

Screening of potential items for component breakout is normally done at the prime contractor's facility, where contractor experts, drawings and documentation are available. The screening process identifies items which can be broken out from the prime contract and procured from another source. The model uses a screening price

determination based on the presumed number of hours of expended effort required for the screening effort, multiplied times the average grade of government participants performing the screening task. The result is the screening price entry for the breakout effort.

Price analysis validates prices for items which will be procured from a single or sole source. This is an attempt to find a should cost price if the item were acquired under competitive conditions. This model uses what it designates as Level I and Level II price analysis reviews. Level I price analysis reviews are assumed to be accomplished rather quickly, perhaps in an hour. A Level II review is more extensive and includes material, process, and labor estimates. Based on a contractor using AFLC data, a Level II analysis will take, according to the computer model assumption, 12.5 hours. The price analysis is also a function of complexity, process, and size. The model assumes these factors are explained by the use of engineering drawings, and that the relative time required for analysis is related to the number of class one drawings for each component or item in the breakout. There are developed formulas to weight either the Level I or Level II based on AFLC average figures (14:12).

Source approval is the review of potential sources through independent appraisal. The model incorporates AFLC studies which suggest this requires about 20 hours per person per plant visit (14:13). The number of people times

20 times number of plant visits becomes the source approval cost the model will use.

Source development usually validates the capability of a second source for a noncompetitive item or a single source item. AFLC data indicate an average of 120 hours of government effort to complete source development (14:14). If a visit to the contractor's facility is required, the model assumes 20 hours per visitor as the approximate time for this element cost.

Source selection is the government activity of evaluating proposals to specific government requests, and selecting the source providing the best proposal which meets all minimum government specifications. When participating in a source selection the government personnel devote all their duty time to the activity. Source selection by itself is complicated and time consuming, but the difficulty increases exponentially with the number of proposals being evaluated, or linearly as a function of cost of the item(s) under consideration (14:15).

Reverse engineering ranges from simple substitution of government or industry specifications to missing contractor specifications or the government lacking data rights for development of a major portion of the engineering documentation needed to produce the item. Two levels of reverse engineering are Level I and Level II. Level one may normally be accomplished by review of available data and use of general engineering knowledge. Level II is more extensive, and includes measuring and detailed engineering

analysis. Reverse engineering costs are determined by the average grade of personnel accomplishing the activity.

First article acceptance is the inspection and acceptance of the first article of a multiple item buy manufactured by the contractor. First articles are used to demonstrate the capability of the contractor to manufacture the item(s) specified by the contract. Normally production will not begin until the first article inspection is completed by the government and passed by that contractor. First article cost used by the model is determined by the average grade of the personnel accomplishing the activity times the number of presumed hours spent on the activity.

Contracting costs are determined by the Workload Assessment Guide developed by ASD and are depicted in Table I. The assessment estimates the required manpower as a function of total value of procurement and contracting methods. This function is also based on the average grade of the personnel accomplishing the activity (14:17).

TABLE I

Workload Assessment Guide

Dollars Contract value	Hours Required Sole Source	Hours Required Competitive
0 - 25K	55	55
25 - 100K	125	125
100 - 500K	150	250
500 - 1M	245	335
1M - 3.5M	375	1725
3.5M - 10M	450	2600
10M - 25M	520	2600
25M - 100M	575	3875

Pre-Award survey is necessary when a new source is being considered for the contract award. The government makes an assessment of the responsibility and responsiveness of the offeror. AFLC data indicate that 1/3 of new offerors require a pre-award survey and 40 percent of these require an on site visit (14:18). The model uses a pre-award survey time requiring 5 in-house assessment hours plus 6 hours per person for the site visit times average grade of the personnel performing the survey.

General SPO costs covers items and management activities the SPO accomplishes, like engineering change proposal reviews, interfacing, new technical order changes, and other items normally accomplished by logisticians in system manager roles. General SPO costs are calculated by average grade multiplied by time involved of the appropriate people.

The model uses administrative and audit costs which are estimated as a percentage of the total CBO item(s) cost (14:19). Security costs are based on number of personnel security investigations required, plant security costs, and DOD inspection costs at each plant, and transportation security. The security costs are also determined by the classification level and the different clearances necessary to complete the CBO project at a new facility.

Equal opportunity program costs are derived from size of the organization and whether the contractor has operating programs meeting standards prescribed by current federal law

and Air Force regulations. If a new contractor does not comply, and must comply, the cost is determined by formula estimate. The model assumes $10 per person times the number of employees.

Socio-economic program costs are associated with the costs of monitoring programs such as small business initiatives, small disadvantaged business, labor surplus etc. These costs are incurred by the Air Force when new contractors are assured to be in compliance with law. The model again assumes $10 per person times the number of employees.

Warranties are purchased when they are perceived to be in the best interests of the government. If warranties are included in the CBO price, the model uses zero for warranty costs. If not included in CBO price, but purchased by the government, then this cost is entered by itself (14:21).

Termination costs with the contractor generally include a termination cost to the government (14:21). The termination costs are included in the CBO offset cost calculations in the model.

If a new contractor begins a contract with the government, the cost of new equipment is a cost passed along to the government. The new equipment cost is also included in the computation of the CBO offset costs (14:22).

In a parallel vein, the facility modification costs, while similar to new equipment costs, refers only to the modification of the facility. This cost is also passed along to the government (14:22).

Another cost generated by CBO is the cost of transporting a CBO item from the new contractor facility to the contractor responsible for integrating the item(s) into the final product. These costs vary with weight, volume, mode of transportation, and urgency (14:22). The model assumes all CBO items are transported under non-urgent conditions and by motor freight (14:22). These item costs are primarily determined in the model by weight and distance. There are two categories for weight, one category is for items under one thousand pounds the other for items over a thousand pounds. The model then incorporates distance from the new contractor and the final integrator contractor facility at specified rates for that weight category.

The solicitation costs in the model are merely the cost of reproducing the solicitation sets for potential bidders (14:23). The total solicitation cost includes manpower, facilities, and several other costs. However, these costs are also included in previous cost calculations. An ASD estimator for solicitation set costs is $10 per set (14:23).

The total SPO costs for the model then becomes the sum of: screening, price analysis, source approval, source development, source selection, reverse engineering, first article acceptance, contracting, general administration, security, equal opportunity, socio-economic, warranty, termination, new equipment, facility modification, transportation and solicitation costs.

The opportunity cost represents the cost of using SPO personnel time for CBO rather than regular responsibilities. One should devote their time to activities having the maximum payoff. In a CBO-SPO situation, the CBO may be the "low priced" item (14:24). However this may not always be true. In this model, a negative value for opportunity cost represents a CBO effort which is more cost effective than normal SPO activities (14:24). The opportunity cost is determined by evaluating the difference of average cost responsibility of the SPO cadre for normal SPO responsibilities and the average cost responsibility of the SPO cadre for their CBO cost responsibilities multiplied times the number of hours dedicated to the CBO effort.

The model incorporates possibilities for weighting wage grades and time for various work breakdown structures. Additionally one may adjust the impact of the inflation rate, using January 1987 as the base period. Fringe benefits are calculated at 27.3 percent (which is the factor used by 2750th Air Base Wing, Wright-Patterson AFB, Ohio) (14:11).

Savings is the difference between the original cost of the item from the prime contractor and the newly estimated price of the component breakout item which includes the new contractor cost to government and the total government costs associated with the breakout item (14:24). The theoretical savings then becomes savings minus the opportunity cost. When opportunity cost is positive in the model, indicating the component breakout effort is not cost effective as

normal progam office activities, the theoretical savings will be less than savings (14:25).

Chapter Summary

This chapter described the research methodology developed by the researcher to accomplish the research objective. The chapter identified the population of concern, the types of data, methods of data collection and assumptions on which the research is based. A copy of the ASD SPO Interview Guide is shown in Appendix A.

ASD was selected as the research site, with primary and secondary sources of data needed. The census of SPO directors was interviewed concerning current breakout procedures. The secondary data sources provided necessary information for making the computer model inputs.

IV. Findings and Analysis

Overview

This chapter presents the research findings and analysis resulting from data collected with the methodology described in Chapter III. This chapter consists of two research phases. Each phase is structured to answer the research questions and accomplish the overall research objective stated in Chapter I.

Research Phase I

Research phase I was designed to answer research question 1: What factors influence the "yes/no" decision concerning component breakout? Beyond gaining insight into the component breakout process through the literature review performed in Chapter II, the interviews with the SPO Directors and the assistance of their respective staifs, one was given substantial information about the breakout decision making process. While some organizations within ASD do not use component breakout, other organizations use it extensively. When conducting the research, first a review of the magnitude of organization participation in the breakout process and then the organizational decision making mechanism was considered. The reason for this emphasis is to examine those who do most of the breakouts and identify how they decide to participate or not participate with a breakout program.

During the research effort, various SPO Directors and acquisition personnel were asked about the decision making

process concerning component breakout. In the following discussion, some of the more common decision factors are cited from interview excerpts. Also presented, in some cases, are paraphrased responses made to a particular question.

The first question asked on the interview form was:

1. How does your organization currently identify (screen) component breakout candidates?

The most common single response related to regulatory guidance. Fifty per cent of the SPO Directors felt regulatory guidance was the basis for determining screening of an item as a breakout candidate. Some interviewees based their screening decisions on AFSC Form 2485. Other respondents cited AFSC/AFLC Regulation 800-31. Still other respondents used Federal Acquisition Regulation (FAR) guidelines, while one suggested that the use of breakout should just make sense for the particular situation. Crucial elements of the regulatory guidance included design stability of the component, available data rights, and quality control of the end item.

The second most common response related to cost. Forty per cent of the SPO Directors based their breakout screening decisions on cost factors. While in some measure this too is predicated on regulatory guidance, the cost basis criteria for screening component breakout candidates used the number of items to be procured, prime profit margins on the item, and SPO costs for managing the item to determine

if breakout was worth trying. If an acceptable level of financial benefit was expected from the breakout effort it then became breakout eligible.

The third most mentioned item was lead time. This concern brought the long lead times of some items, together with funding restrictions of committing appropriated funds beyond legislated bounds, as a reason for not accomplishing more breakout. However the dollar figures were not readily available for the amount of projected savings lost to this conditional restriction.

The second question was:

2. Who, within, the organization, provides inputs to component breakout decisions?

The preponderance of interviewees (90 per cent) made a point of emphasizing group participation in the breakout decision process. Near unanimity existed on staff involvement determining the use of component breakout. Some respondents listed every function within the SPO, others had formal Operating Instructions detailing who would be consulted for breakout decisions.

The third question was:

3. What criteria do you use in the component breakout process? (Cost, reliability, performance, burden on SPO personnel, combinations or other criteria and is one weighed more heavily than others).

The three most frequently mentioned criteria for determining breakout decisions were cost, engineering stability of the component and burden on SPO personnel.

These three responses covered all of the primary reasons cited for component breakout, although issues such as lead time, small business administration considerations, and reliability were also addressed as conditions affecting the breakout.

Cost savings was the chief factor considered in the GFE selection process. Eighty per cent of the respondents used cost motivations as the primary criterion for determining component breakout. Although most interviewees saw component breakout as a method for achieving cost savings, the majority cautioned against automatically assuming the Government could do it cheaper. And even if savings were shown through GFE, the savings could rapidly deteriorate should the subcontractor experience schedule or performance problems. In turn, these problems would influence Government deliveries to the prime contractor and most likely introduce a government financial obligation to the prime contractor thereby reducing the financial attraction of component breakout.

Additionally, most SPO Directors felt that in order to properly evaluate GFE costs Government personnel time spent on managing GFE generated by component breakout had to be included in total government costs. Some previous reports had ignored SPO personnel costs, assuming these people to be on hand whether or not they were involved in breakout. Most respondents of this study did not consider personnel costs to be fixed costs for the benefit of component breakout, but

variable costs, as a prime contractor would if they had to incur additional labor tasking.

A criterion mentioned by 10 per cent of the SPO directors or their staffs was the engineering or design stability of the component. If the configuration of a component is unstable an extensive management and technical effort is required to meet schedule and performance, and to satisfactorily integrate the broken out component. If the component is CFE, the prime is responsible for implementing all changes required and assumes all risk associated with acquisition and integration of that component. Even employing CFE the SPO spends a great deal of time and effort processing engineering change proposals, waivers, and data package updates. Additionally, the SPO continues to monitor performance and test results and provide technical assistance.

Should a component become GFE, the SPO assumes the responsibility for cost, schedule, and performance. Every SPO Director interviewed said if the component was not stable, they would not break it out. However, the issue of stability entered into the equation after cost had been considered. If the items were stable but not worth the cost/benefit ratio, they would still not breakout the component. The typical response was effectively, "Component complexity or the likelihood the integrated system will change, to a large part, determines if the component will be broken out." Should the item demonstrate an unacceptable

threat to cost, schedule or performance it would cease to be a breakout candidate.

The third ranking key issue was the additional burden on personnel. From the personnel resource standpoint of the SPO, the most common concern was the availability of personnel to manage the component breakout once converted from CFE to GFE. The chief reason for this concern was the chance that problems could occur during the acquisition process and the SPO might not have sufficient personnel available to properly resolve the problem or manage the GFE item. The personnel required to manage GFE includes technicians, logisticians, contracting, manufacturing, engineering, configuration management, program control, program managers, administrative personnel and support personnel augmented to field activities.

The respondents generally believed the prime contractors have greater flexibility in manpower resource adjustments than the SPOs. This advantage for primes put them in a better position to make sure a component meeting specifications is delivered on time and can be integrated into the weapon system. As one SPO director put it:

> Once your program leaves development and enters production you face different problems. Problems like strikes, production line problems, delivery schedule troubles, contracting problems and there are more, each of which can become a GFE nightmare. When these problems surface a SPO has to have someone there to follow up and solve it or your entire program could be jeopardized.

Another respondent emphasized the manpower flexibility advantage the prime contractor has over the ASD SPOs when he said, "If you compare the prime contractor's staffing and compare it to mine, it makes sense to keep an item CFE if you want to stay on schedule." The respondent felt it unlikely he could ever match the inherent advantage the prime had on the ability to respond to changing manpower requirements. Another point made dealt with increased span of control for Government employees.

One respondent suggested that when one breaks out a component, thereby increasing the number of contractors to deal with, one multiplies the number of potential trouble spots, and in effect increases the span of control. Perhaps a better choice of words may have been increased area of responsibility, nevertheless, the SPO did not receive an increase in personnel authorizations to deal with the increased responsibility attributable to component breakout complexities.

The fourth question was:

4. What logistical system risks are considered in the component breakout decision? (Operations, support, warranties or any other).

The consensus indicated common use items should be GFE whenever possible. Sixty per cent of the respondents suggested that breaking out common use items would be a reasonable acquisition strategy. Common use items were generally defined as components having use in more than one weapon system program. Common use GFE items could result in

lower life cycle costs through larger quantity purchases and improved logistic support. The conversion from CFE to GFE would require minimal increase by program personnel since larger quantities did not require significant changes in acquisition procedures.

One SPO suggested their organization checked with the Air Logistic Centers (ALC) to make sure the ALCs stocked the item prior to the GFE conversion. This put a buffer in place to minimize schedule, production and unforeseen difficulties before committing to a GFE policy.

Another concern was the lead time considerations for GFE. Lead times were addressed by thirty per cent of the respondents. The lead time concerns were dispersed among categories. Some of the lead time categories were: the time required to acquire a data package and prepare contracts; time for contract award; time to manufacture the item; delivery times to prime; and prime contractor's installation time. Generally the respondents felt the Government took longer than primes to accomplish breakout functions because of additional requirements placed on the SPOs. And prime contractors were believed to have an advantage over SPOs because the prime contractors could protect themselves by ordering equipment well in advance of Government funding availability.

With respect to concern over breakout and warranties, the experts were divided. Some were convinced that warranties had no effect on breaking out the component,

while others were equally convinced that warranties were a reason for not breaking a component out.

Some SPO Directors felt the use of breakout would blur the responsibility and liability of a warranty. In fact some thought the warranty would be next to worthless in a breakout situation. One of the largest breakout SPOs at ASD suggested that warranties were a reason for not breaking out a component. The fundamental reason justifying a nonbreakout decision was the interruption of the producer-user relationship. A producer manufacturing a weapon system covered by a warranty, may try void the warranty when the Government supplies and handles a component used in that weapon system. When components are provided as GFE, the responsibility of the prime contractor for ensuring total system performance under the warranty is blurred by the fact the Government assumes responsibility for problems caused by the GFE components being provided. And if weapons systems performance problems do surface, it often becomes difficult to determine whether the problems were caused by the CFE or GFE components. This further reduces liability on warranty provisions of the contract.

On the other hand, thirty per cent of those interviewed reasoned that warranties made no difference when conducting breakout. The mere fact that the Government furnished some equipment to the prime contractor for subsequent end item use within the weapon system does not by itself alter the warranty coverage in any manner. The prime contractor would not have been in any different position if that same GFE

component came straight from the subcontractor facility with a delivery agent acting as intermediary. Part of the explanation for these opposite opinions rests with the nature of each SPO, its prime contractors, subcontractors, the eligible component and its warranty features.

The fifth question was:

5. How will economic factors and quantity changes influence component breakout decisions?

The answers to this question covered the spectrum of possibilities. The range went from no effect on the decision to a prime consideration. In one instance the SPO initially had a firm multiyear commitment for a specified quantity of weapon systems. The SPO made the breakout decision early in the program rendering economic and quantity changes irrelevant. However, the other SPOs had varying opinions.

One respondent stated that "the SPO knows the benefits before we get into the breakout. And if we don't have justifiable quantities we are not breaking it out." Another respondent said, "The bigger the buy, the more economical it [breakout] becomes." And in a similar context, but stated another way, one said, "A move in quantities upwards increases our savings." If the purchase quantity for the planned fiscal year buy is low, the Government may not achieve sufficient cost savings to make a conversion from CFE to GFE worthwhile.

Additionally, low quantities placed the Government in an undesirable negotiating position when dealing with the GFE vendors. For example, if a small quantity of components were ordered, the subcontractor supplying the component may not be interested in receiving the contract award if this contract were a small portion of his overall business base. Should the subcontractor submit a proposal under these circumstances he will more than likely be a hard negotiator, especially with respect to price and delivery schedules. Still, the final contract would have to be acceptable to both parties with respect to quantities and prices before component breakout could be used.

One general contention of the respondents was that the prime contractor had a great deal more leverage over the subcontractor than did the Government, and the prime contractor could get better prices and negotiate better delivery schedules, especially when ordering a small quantity of components. The respondents felt if the subcontractor is unreasonable during negotiations, the prime, if he has other business with the subcontractor or prospects for future business, can threaten to take his business elsewhere, unless the subcontractor cooperates.

A number of the respondents felt that unless there are sufficient years left in the economic life of the program, normally it is not worthwhile to convert from CFE to GFE. In these cases, the life cycle cost benefit achieved by component breakout is considered minimal and is usually not worth the trouble of assuming the risks associated with GFE.

One SPO suggested that quantity changes will not make a difference. "The contract price will not change and if we order under that contract it will make no difference." The reasoning appears straightforward enough, but may not address the underlying principle of establishing the sensitivity of quantity changes towards GFE or neglect the economic considerations GFE decisions usually entertain.

The sixth question was:

6. What responsibilities will government share or assume as a result of approving component breakout?

Eighty per cent of the respondents said the Government shoulders all the responsibility for schedule, delivery, and quality in breaking out a component. Twenty per cent said there was a give and take of all the responsibilities in the breakout procedure. One specific response was, "We assume hardware responsibility only on the end item being in the right configuration, at the right time and place." While the other sentiment expressed was that the difficulties, risks, and burdens were shared by the subcontractor, Government and the prime contractor. Ultimately, those SPOs said, some of the responsibilities and liabilities are negotiated, towards the end of the production run, to determine the final status and financial penalties associated with the weapon system.

When asked if the responsibility could be passed along to the subcontractor in the form of covering complete

Government liability for the breakout components, the SPOs resoundingly answered no.

The seventh question was:

7. If an item is broken out, what will determine if the item is sole sourced or competitively awarded?

Among ASD SPOs, twenty per cent would sole source the item, fifty per cent said they would competitively award the item, and thirty per cent said the award would depend on the nature of the circumstances of the program, the component, time frames involved, and other requirements. The respondents answering that they would make the GFE a competitive award, said the competitive award was the preferred strategy for driving down the component costs. Of the respondents suggesting a sole source award for a broken out component, those SPOs were faced with availability only from the single vendor.

The eighth question was:

8. Do you believe the use of component breakout makes the original prime contractor accept profit reductions or increase their efficiency?

Forty per cent of the SPO Directors believed that use of component breakout makes the prime contractor accept lower profits or increases the prime's efficiency. Forty per cent did not believe breakout affects the primes. Twenty per cent thought it to be conditional, depending on the component to be broken out and the prime to whom the component would now be supplied.

Some respondents were convinced this question should have been worded to include use of the threat of component breakout. Most respondents felt the threat of component breakout did make prime contractors accept lower profit margins, increased prime contractor efficiency or both. Seventy per cent of the respondents thought the threat of use of component breakout to be effective in attaining those intended goals. As one respondent put it, "You have to threaten to use component breakout every so often, and use it in praccice when it is to your benefit, in order to make the practice effective."

Among the SPO Directors feeling that component breakout use did not affect the prime contractors there existed the belief the prime was about as efficient as market forces dictated. Prime contractors felt if the Government thought it could do the prime contractor's job more efficiently than the prime contractor and the rest of the market then the Government should use component breakout and was welcome to use the practice.

The ninth question was:

9. What do you consider the greatest drawback to using component breakout?

Seventy per cent of the respondents emphasized the increased workload on the SPO compared to the benefit gained as the greatest drawback to the use of component breakout. Thirty per cent of the respondents said risk accepted by the SPO was the greatest drawback to the use of component breakout. While not every answer was verbally identical

covering the burden placed on SPO personnel, the sentiments the respondents expressed were parallel to the category of the answer. Some respondents phrased it with work-to-reward ratio, some respondents said burden on people in the SPO, while other respondents just said number of people to manage breakout properly. Under the heading of risk, this researcher also included the response of uncertainty. One respondent said uncertainty was what he considered the greatest drawback, and while uncertainty and risk are separate entities, the two responses were grouped for the purpose of this analysis.

The tenth question was:

10. Would a computer model be helpful for component breakout decisions?

Forty per cent of the respondents believed a computer model would be helpful in determining breakout decisions. Twenty per cent of the respondents answered no, that a computer model would not be of any use in making breakout decisions. Forty per cent said they would look at the model and see if it offered appropriate information to help solve breakout decisions.

The eleventh question was:

11. Would your organization use a computer model if one were available, accurate, and relatively straightforward?

Forty per cent of the respondents said they would use a model if one met those conditions. Twenty per cent stated

they would not use a model to make breakout decisions. Forty per cent said they would look at the model and then decide whether it applied to the particular situation at hand.

Summary of Research Question One

The following table summarizes the interview results. The number on the left corresponds to the interview question number, followed by a key word from the interview question format as a verbal reference to that particular question number, followed by the general categorical responses and the percentages of responses for the category.

TABLE II

Breakout Decision Factors

Questions	Categorical	Response	Percentage
1. Screening	regulation 50	cost 40	lead time 10
2. Members	staff 90		selected 10
3. Criteria	cost 80	stable 10	burden 10
4. Logistics	common use 60	lead time 30	warranty 10
5. Quantities	direct 50	no affect 20	n/a 30
6. Responsible	Government 80		shared 20
7. Awarding	compete 50	single 20	dependent 30
8. Efficiency	yes 40	no 40	dependent 20
9. Drawback	burden 70		risk 30
10. Model	yes 40	no 20	dependent 40
11. Use	yes 40	no 20	dependent 40

Research Phase II

This phase is designed to answer research question 2, what are the predicted savings or losses that result from using component breakout?

No definitive guidance exists in DOD to assist practitioners in forming standard methods for estimating or

documenting net savings in breakout efforts. Small wonder that Government auditors note inconsistencies among program office breakout reviews and methodologies used to estimate cost savings. Consequently, the potential exists to improperly estimate breakout costs or figure potential savings. This could lead to erroneous breakout decisions. On the other hand, the lack of guidance may be a vote of confidence in the integrity and fidelity of managers to perform in a relatively unrestricted environment, fully knowing that not every eventuality can be addressed in regulation format, allowing them more freedom in duty performance. Nevertheless, the manager's decision may rest on how finely one can calculate the savings from breakout, and weigh them against risks and uncertainty.

Accurately estimating net cost savings attributable to breakout requires careful identification of factors contributing to gross saving as well as adjustments to those savings. For example, eliminating the prime contractors' direct labor, overhead, and profit are quantifiable amounts contributing to gross breakout savings. Should a pricing history of the breakout component exist, one could reconstruct relevant figures from contract files and calculate the savings. But other factors affecting savings, such as savings attributable to competition, are not readily available or apparent, and are difficult to quantify. The quantifiable offsets to gross savings are numerous and vary in importance by program.

However, the calculation of net cost savings must account for more than a list of tangible offsets to savings. One needs to account for the intangible offsets as well. Here one must subjectively consider the future consequences of increased risk and uncertainty now assumed by the Government in performing component breakout. The risk and uncertainty may manifest themselves as higher unanticipated program costs due to schedule delays, component failure, integration problems, or weapons system performance problems. These cost are very difficult if not impossible to quantify. While the managers do not have perfect information, the SPO Director can only exercise judgmental assumptions about future program outcomes. Program risk and uncertainty concerns may come true over the life of the program.

On further research on this matter, a General Accounting Office report on component breakout said:

> However, DOD has no regulations describing the methodology to be used in determining reportable savings and costs of the Breakout Program on parts actually purchased. Therefore, the services and DLA [Defense Logistics Agency] have developed their own methodologies to determine savings and costs associated with purchases. [20:30]

The report went on to say that because there were no procedures for determining and reporting savings due to breakout efforts, the services and DLA use their own methodologies which are not consistent. (20:30). This researcher found that to be the case within the SPOs as well. Some SPOs used popular, commercially available computer spreadsheets to calculate costs and estimate

savings, other SPOs used manual methods. The sophistication of the means used to calculate the breakout savings ranged from detailed to simple.

One SPO was testing an analytic hierarchy process based on a commercially available decision support system to determine if component breakout was profitable and risk acceptable. This decision support system structured the decision making process on component breakout. By taking what the SPO considered were relevant elements, the elements were then programmed with decision rules and procedures. Whether or not this decision support system gains wide acceptance as a means of doing business, or is even valid, depends on further demonstrations of the results. This particular SPO seemed to be pleased with the operation of this decision support model, and results of the decision support system and the SPO will probably continue to use this system. This researcher doubts the stated accuracy of this system though. It is hard to trust a decision support system which purports valid numerical ratings to the one-one thousandths decimal place on a subjective opinion. Not all programs, however, used sophisticated methods and means to determine costs.

Another SPO, for instance, used a relatively simple, manual method to determine if component breakout was profitable for the Government. The SPO had 52 candidate items possible for breakout during the previous fiscal year. Of these 52, 15 were selected for actual breakout with an

estimated cost savings of $20,482,000 over the anticipated life of the program. Of the remaining 37 items not broken out, 17 were not considered to have adequate cost savings, 11 items were considered technically unstable, 3 did not have sufficient lead time to secure adequate funding, 5 were assembled from other parts and produced no end item to breakout, and 1 component required redesign to accommodate other known changes to the aircraft. In the next fiscal year the SPO had 22 candidates for breakout, with 12 selected for breakout, with a projected savings of $19,890,000 over the remaining program life.

Yet another SPO had a multiyear procurement arrangement for the years 1990-1993. This SPO had 47 candidates for breakout, and eventually intends to breakout 6 of the candidates. The project savings for the breakout items is $56,000,000 based on the contractor costs of the previous multiyear arrangement, so the savings are probably conservative. The basis for comparison between the prime contractor cost and the Government cost was what the SPO calls Multiyear 2, or Fiscal Years 1986-1989 in laymen's terms. The SPO used the prime contractors costs from the previous contract, or the Multiyear 2 contract prices to determine future savings and added a 30 per cent markup that the prime traditionally uses on CFE items. For the 41 items not broken out, most were attributed to unstable design, 25 items, and 10 items had data rights problems. A number of items were not broken out due to a DOD test program of recompeting the items. This SPO had a fairly sophisticated

computer program spreadsheet which considered relevant costs over the life of the program.

In the Training Systems SPO, a component breakout program was not maintained for a number of reasons. First, some of the simulator programs are procured as Aircrew Training Systems. The Air Force pays for a trained crew member, not a simulator device. Component breakout is not considered for these type programs. Second, other simulator programs have been or will be converted from organic support to contractor logistics support. Equipment broken out could adversely affect the contractor guaranteed availability. Third, most of the high dollar items meeting the dollar threshold for breakout consideration on aircraft are avionics, computers or computation systems. The simulators do not require the actual equipment, but reproductions of similar likeness which can controllably imitate actual equipment. And finally the simulators are not purchased under annual buys. Usually the development and total production buy are competed and procured under a single contract, limiting the use of component breakout. This SPO has determined it has no need to calculate savings due to breakout.

The B-1B procurement process was unique in a number of respects relevant to the component breakout process. First, the program was limited to a production run of 100 aircraft, plus support equipment and spare parts. Second, the aircraft, avionics and engine production were initiated

several years ago under an expanded advance buy and multiyear procurement contract. This procurement strategy led to a single component breakout review early in the program. By means of this review, seven major aircraft systems were broken out. No further production is planned. The total cost savings attributable to the use of component breakout was not readily available.

The strongest case for the advocacy of breakout was the Deputy for Propulsion, often called the Engine SPO, which acquires an engine from a manufacturer, transports it under a Government Bill of Lading (GBL), and provides the engine to the prime aircraft contractor. The SPO estimates it has saved about $4 billion during the entire life of the SPO when compared to the cost of buying the engines CFE from the prime contractors. The following table shows some of the intended buys for the calendar years 1989, 1990 and 1991.

TABLE III

Planned Engine Procurements

Engine	1989	1990	1991
F100-220	221	200	175
F100-110	171	144	112
F100-100 & -200	19	25	16

Considering the cost of a single United Technologies Corporation's Pratt and Whitney F100-220 engine in mid-1985 was $2,993,228, according to the SPO, the total costs are substantial. While the numbers contained within the table

are tentative and based on the expected budget projections, the numbers shown are the best available current estimates.

The decrease in numbers of engines to be acquired acquired as years progress is misleading. Pratt and Whitney is developing an improved version of the F100-220, which is designated the F100-229. As this engine development stabilizes it too will be purchased and probably begin augmenting the later year purchase projections. Likewise, General Electric, the manufacturer of the F100-110, has an upgrade in the works designated the F100-129, this engine will also be procured in the later years of the schedule. The 1991 projections are more than likely incomplete from the standpoint of including these derivative engines.

The F100-100 and -200 engines are procured for Foreign Military Sales (FMS) cases. These engines are being transferred to AFLC for management responsibility.

Two additional engine designs are not depicted on the table, but are likely to become GFE. The C-17 engines are manufactured by Pratt & Whitney, carrying a corporate designation of the F117. After the thirteenth production C-17 aircraft, the F117 engine will become GFE. The current projected buy of C-17s is 210 aircraft with production spread through the 1990s. The other engine not represented is the General Electric F118 engine, which is based on the General Electric F110 core engine. The F118 will be produced for the B-2. The current projected buy for the B-2 is expected to be 132 aircraft. While there is no scheduled

date for the transition to GFE status for the F118, it will probably follow on as a GFE engine once the program classification permits and design and production stabilizes.

Aircraft engines are suitable as GFE items for a number of reasons. First, jet engines are a high value element of aircraft costs. The costs a prime contractor would add as their management fee for the integration role would make the weapon system much more expensive. Second, the engines are not broken out until the design stabilizes. This reduces schedule, production, and quality risks associated with component breakout. Third, the use of competitive awards with respect to engine breakout reduces the procurement cost. Additionally the GFE award to multiple sources diversifies the production base. Clearly the engine breakout policy is a success story from several perspectives.

Summary of Research Question Two

Throughout the research process, this researcher found that each SPO had unique considerations and problems associated with determining component breakout savings or losses. Certainly the SPOs had common problems, but the existence of peculiarities were legitimate concerns, and complicate the determination of final savings or losses. Finding a consistent method for determining savings or losses associated with component breakout for the near term appears to be optimistic. But understanding and using a standard format may at least be a starting point for future

comparisons and analysis covering the component breakout process.

The Sweeney model is really a tool for decision analysis on component breakout. The model permits the user to entertain sensitivity considerations, become familiar with the effects of changing variables, and see projected savings or losses associated with the changing variables. The SPOs would be able to make better decisions concerning component breakout procedures using this model if the SPOs used it a few times. The model appears to conform to the needs of ASD's SPOs concerning component breakout. However, this component breakout model is a tool for planning and future oriented behavior not a post-decision comparison device.

In determining the predicted savings or losses associated with the component breakout process, many SPOs do not follow up on the component breakout results and do not compare the alternative cost to the actual cost after the fact. Just trying to find the estimates required to run the Sweeney model is difficult enough within the various SPOs; whether the actual numbers are available or completely exist is another matter. SPOs do not use the same structure or format in calculating their costs, rendering large variations in what would become the projected savings with the use of component breakout. For pure operation the Sweeney model appears to represent the considerations necessary to calculate savings and losses. At least the use of a common model would permit the development of a data

base and eventually allow a consistent evaluation of the breakout decision process. Then, as the model's shortcomings were identified, improvements could be made. An example of one SPO's comparable component breakout calculation format is shown in Appendix B.

V. Summary, Conclusions, and Recommendations

Overview

This chapter summarizes the research performed in accomplishing the research objective, draws conclusions about research findings, and presents recommendations. A summary of the research performed will be presented first, followed by conclusions about the research findings. The recommendations resulting from this study will be presented last.

Summary

The first portion of this research project had three elements contained within it. First, a literature review of the history and development of component breakout provided some insight into the current basis for component breakout decisions. Then a series of unstructured interviews with component breakout experts was used to build an interview format for gathering data. Finally, the interviews of ASD SPO Directors and often with their staff experts was used to gather the data necessary to build the overall observations.

In conducting this research, the researcher contacted sixteen SPOs at ASD. Some SPOs declined to be interviewed on the basis of not conducting enough component breakout to warrant inclusion in the data base, other SPOs declined the interview on the basis of classified material. The final number of interviews granted was ten. The time an interview took to complete ranged from thirty five minutes to seven

hours. The length of time an interview required to complete had no distorting effect in any of the tables or data presented within this research. SPOs wishing to maintain anonymity for this study, remain anonymous. Those SPOs to whom anonymity did not matter, were referred to by name, however, the personnel within the SPO were not mentioned by name anywhere within the thesis.

The second portion of this research effort looked at a number of methods for comparing and estimating cost savings concerning component breakout. Originally, the research effort began with the Sweeney model for determining savings using component breakout. After a deeper involvement in this area, one sees a number of difficulties, different methodologies and separate systems for determining savings. Each SPO uses its own methodology to determine the cost savings. This researcher does not intend that comment to be a derogatory statement, merely a descriptive statement of conditions as they currently exist.

Conclusions

The component breakout practices of major weapon system program offices vary to a considerable degree in ASD. While some SPOs have implemented well-structured component breakout programs, other SPOs are neophytes in the process, still others view the component breakout process as their nemesis. In a number of cases, little documentation is maintained to substantiate reasons why decisions were made not to break-out high dollar components.

Component breakout is not a popular process with a number of SPO Directors and their staffs. The reasons vary from SPO to SPO but the importance of the burden placed on the SPO personnel and meeting cost, schedule and performance requirements frequently drives the determination not to break a component out. There are many risks to the SPO in providing GFE to the prime contractor, and often the SPOs see significant advantages in assigning total responsibility to the prime contractor as a preferred acquisition strategy. In their final analysis, some SPOs consider the use of a component breakout strategy as not in the best interests of the SPO or the Department of Defense.

While the GFE decision does increase program risk exposure, there are benefits gained through the process. Some of these benefits are:

1. Cost savings gained through eliminating the prime contractor's markup.

2. Cost savings through quantity discounts and competition.

3. Life cycle cost savings and improved logistics support through the purchase of common use items.

4. The ability to maintain tighter configuration control.

5. Increased Government participation in Small Business and disadvantaged businesses.

6. Broadening the industrial production base.

Often, the SPOs will not breakout a component for one or two considerations without examining all relevant decision factors. When assessing the risks and benefits,

SPOs sometimes make the decision on use of component breakout with a partial list of factors, not considering the entire range of factors normally influencing a breakout decision. If significant cost savings or other benefits can be achieved by breaking out components, the SPO should weigh all the relevant benefits against program risks then make the decision.

The researcher found a large disparity in the amount of breakout activity among the various SPOs at ASD. Although some SPOs are much larger than others, with substantially more breakout potential, breakout is frequently relegated to the last possible consideration for procuring the components. Documentation maintained on component breakout varied throughout ASD. Some SPOs maintained detailed analysis on components that were broken out, including estimated cost savings on each item considered for breakout, while others kept few documents on their breakout decisions. And there is no standard review process among SPOs when making a component breakout decision. Subjective regulatory guidance covering cost savings leads to inconsistent breakout decisions at the SPOs.

Another way to look at ASD and the prime contractor relationship is through the viewpoint of economics. On the demand side, the Government is the sole purchaser of this aircraft output, if one neglects FMS cases. This demand side arrangement characterizes a monopsony. While the Department of Defense is formally a single buyer, in

reality, it consists of the service components, each having particular requirements, competing with each other for defense dollars and, in so doing, influencing defense demand. Similarly, within the individual services there are a variety of factions with competing objectives and visions which influence the nature of demand.

In examining the supply side, there is a handful of large corporations, the prime contractors, which form an oligopoly. Immediately below the prime contractor layer, there exists a far larger number of companies providing goods and services to the aeronautical industry. The structural framework of the defense aircraft marketplace, and the framework within which ASD works, is characterized as a monopsonistic-oligopolistic arrangement.

The crux of the defense aeronautical marketplace is this relationship between the defense contractors and the Government. This relationship is expected to be at arm's length given that the defense contractors are private corporations and therefore outside the direct authority of the Government. Defense contractors do not expect to be compelled to do business at a loss, and furthermore, do rely on the Government to support and maintain capacity and ensure at least minimal profit levels. The institutionalized interdependence between the Government and defense firms is a departure from the usual customer-producer relationship of the civilian economy and markets.

In examining the defense prime contractors and subcontractor arrangement there exists a hierarchical

relationship. The following table shows the marketplace in levels of the assembly process. While the table may be a somewhat simplified version of the relationships that exist, one may find it helpful for the purpose of illustration. This tablee presents the position and structure of the supply side or oligopoly with which the ASD SPOs must deal. This tablee does not include the demand side, or the Government position within the relationship.

TABLE IV

Airframe Assembly Hierarchy

Level 1	Level 2	Level 3
Prime Contractor	On-Board Avionic Systems	Electronic and Electrical Components Electrical Systems
	Propulsion Systems	Engines and Components Engine Accessories Starting Systems
	Airframes, Structures, Subassemblies and Subsystems	Fuselages and Structures Interior Cabin Systems and Components Environmental Control Systems Fuel Systems Landing Gear Systems Hydraulic Systems

At this point the logical question one would wish to ask is which policy measures or factors work with regard to component breakout and this hierarchical structure and which do not. Unfortunately the answer is more complex than a single variable which fits a static picture. More than likely, there is no precise formula for successful

determination of component breakout in all possible cases. But there are rules which permit one to generally suggest that the use of component breakout is appropriate. Of course, similar measures used in different circumstances yield different results. This is not surprising since every SPO contains unique considerations, risks, requirements and capabilities.

Often the SPOs are viewed as essentially a competent clerk following a predetermined set of behavioral rules. But technologies, resources, and demands are not always constant and the resulting decision making rules are then not always interchangeable. A static picture of SPO behavior and conditions is an inadequate characterization of the experimentation, error making, partial correction, and insightful, blind or lucky behavior encompassing major technologically advanced activities of SPOs and the corresponding private enterprises that are attempting a production not accomplished before. Should this kind of groping and stumbling be an apt description of SPOs attempting to enter new and unfamiliar technologies and products, a single formula would offer some guidance of process and understanding but yet leave substantial influences unmentioned.

In providing rigid guidance based on a single variable within a dynamic setting one may do as much harm as good. However, by looking at all the relevant, known variables over the foreseeable future the SPO Directors

could properly weigh advantages and disadvantages and come out with an overall indicator of success or failure.

Recommendations

Identify All the Relevant Variables. Often a SPO will use a checklist in determining appropriate use of component breakout, but not use the entire checklist. Without examining all the relevant factors affecting component breakout, one gets an incomplete analysis of the procedure and may not enter an advantageous situation or bypass the disadvantageous ones.

Standardize the Procedures for Calculating Cost Savings. ASD at least, or even better, AFSC, should provide a standard procedure for calculating the costs associated with and savings realized from component breakout. Currently, regulations recommend the use of component breakout if the procedure results in sufficient cost savings. Since sufficient cost savings is a subjective judgment, and each SPO has its own method for calculating cost savings, little is common between organizations. A standard method of calculating cost savings, and amount of cost savings required would aid in making and comparing component breakout decisions. The model described in Chapter III is a superb starting point for this standardization procedure.

Provide Guidance for Converting from CFE to GFE. The guidance should address the difficulties in the transition

from prime contractor furnished equipment to Government furnished equipment. This would help smooth the organizational turbulence and perhaps allay some fears associated with the conversion.

Fully Document Breakout Decisions. AFSC should provide standard guidance for fully documenting all breakout decisions. This policy would force SPOs to perform more detailed breakout reviews. To take advantage of component breakout benefits, the managers should then establish and implement a well structured program to make sure the high return items are identified and evaluated.

Replication of this Study. In an effort to establish greater confidence in the research results, a replication of this study at other AFSC product divisions or for AFSC as a whole would generalize the findings from ASD. Another researcher may discover new findings and provide more recommendations that would help evaluate the use of component breakout.

Appendix A: ASD SPO Interview Guide

Date ____________ Name ________________________

Rank ____________ Off Symbol ____________________

Phone ___________ Referral ______________________

1. How does your organization currently identify (screen) component breakout candidates?

2. Who, within the organization, provides inputs to the component breakout decisions?

3. What criteria do you use in the component breakout process? (Cost, reliability, performance, burden on SPO personnel, combinations or other criteria and is one weighted more heavily than others).

4. What logistical system risks are considered in the component breakout decision? (Operations, support, warranties or any other).

5. How will economic factors and quantity changes influence component breakout decisions?

6. What responsibilities will government share or assume as a result of approving component breakout?

7. If an item is broken out, what will determine if the item is sole sourced or competitively awarded?

8. Do you believe the use of component breakout makes the original prime contractor accept profit reductions or increases their efficiency?

9. What do you consider the greatest drawback to using component breakout?

10. Would a computer model be helpful for component breakout decisions?

11. Would your organization use one if one were available, accurate, and relatively straightforward?

Appendix B: An Example of a SPO Breakout Calculation

FY ______ Component Breakout Data

ITEM NOMENCLATURE:
NSN:
Vendor Part #:
Breakout Qty:

Cost and Savings Information

(1) Prime contractor cost:

(2) Prime contractor mark-up: _______ (_______%)

(3) Prime contractor price: ((1) + (2))

(4) Air Log contractor price: _______

(5) Net Difference: Per Unit

Calculation:

________ (5) (If Savings)	X	________ Breakout Quantity	=	(6) ________ Net savings/ total

Significant Savings Criteria

________ (2)	X	________ Breakout Quantity	=	________ Total cost avoidance (7)

Does (6) exceed (7)

Yes
No

If yes, savings criteria is significant and item is breakout candidate.

FY ______ Component Breakout Data

Procurement Lead Time Calculation:

ALC Admin Time: ______ Months

Vendor Production: ______ Months

Total Procurement L/T ______ Months

Other Lead Times (If Applicable)

Prime contractor Docktime ______ Months
(Prior to install date)

Total Lead Time ______ Months

Does Lead Time exceed ______ Months

Yes
No

If no, item meets breakout candidate criteria

Breakout Candidate

Yes
No

Actions to be taken concerning lead time constraints:

FY ______ Component Breakout Data

Breakout Candidate/Threshold Determination

Item Nomenclature:
NSN:
Vendor Part #:

Quantity for Breakout (B/O)

______	X	______	=	______
(1) # Units Remaining		(2) # Items Per Unit		(3) B/O Qty

$\frac{1,000,000}{(3)}$ = ______ (4) Unit Price Threshold (This Item)

$\frac{1,000,000}{(1)}$ = ______ (5) Basic Threshold

(6) Does (4) exceed (5)?
Yes = Breakout Candidate
No

(7) If no, is there more than 1 item per unit?
Yes
No

(If yes, continue as a breakout candidate)

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Block 19. Abstract

The purpose of this study was to examine and analyze the component breakout decision process. The research methodology consisted of a literature review, and personal interviews with Aeronautical Systems Division program office directors and their staffs. Then an examination of records concerning prior breakout decisions was conducted to compare available data.

The research revealed that the use of component breakout varies among the System Program Offices, and each office approaches the breakout decision process differently. Currently there is no standard method for estimating the savings, however, one available computer model could become a basis for standardizing breakout decisions. Often a non-breakout decision is made without identifying all relevant variables concerning the process. There is little guidance for the program offices for converting from contractor furnished equipment to Government furnished equipment. The documentation concerning the breakout process is sometimes fragmentary.

Among the recommendations of this study was the need for a consistent method to calculate component breakout savings, and fully document the breakout decision. That would help organizations make sound breakout decisions and then the considerable savings produced by component breakout could be realized.